Antimicrobial Resistance and Hormone Degradation

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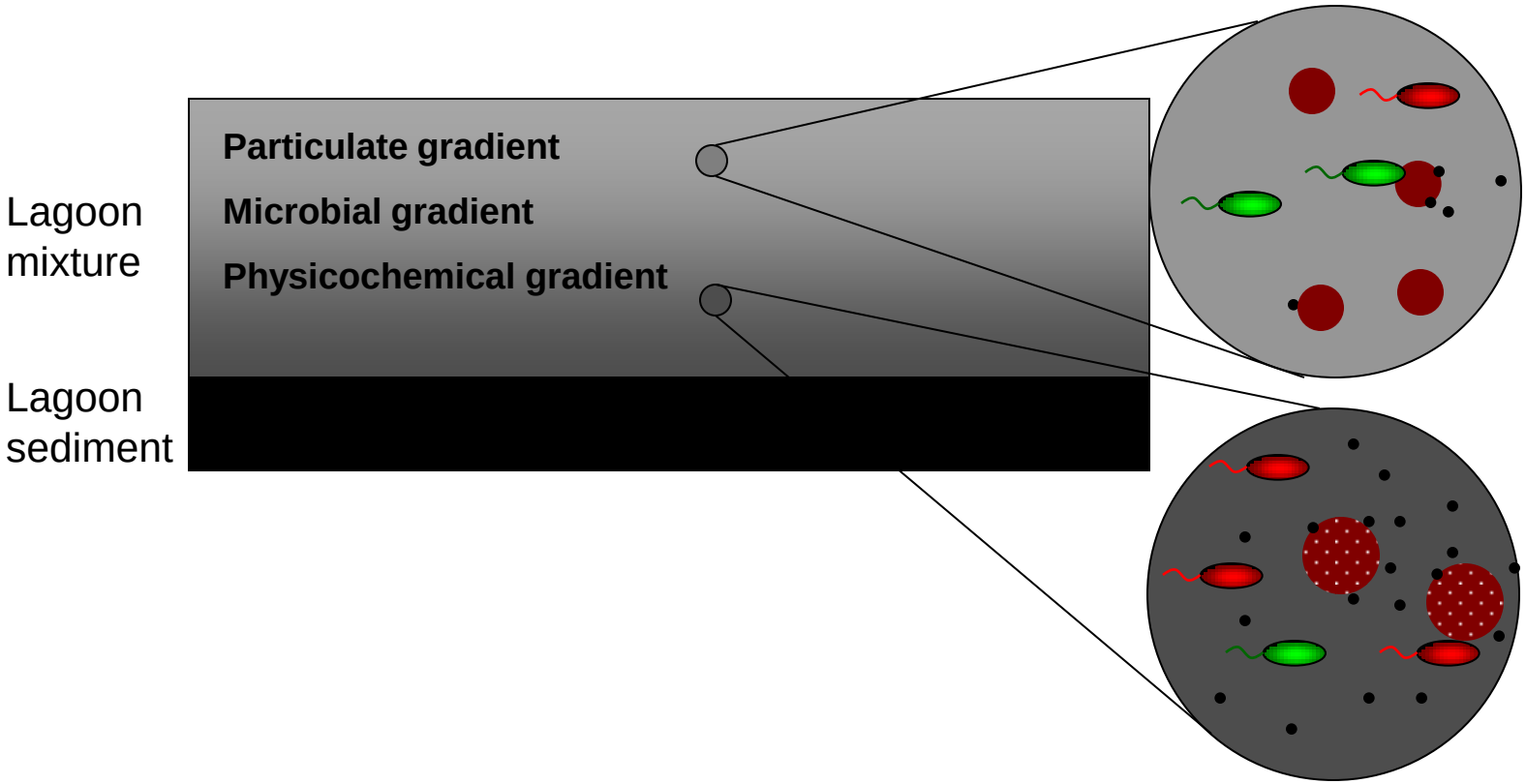
Research Focuses

1. Fate, transport, and mitigation of antimicrobial resistance genes in agricultural and engineered systems
2. Mechanisms of microbial hormone degradation and removal of hormone using bioreactors

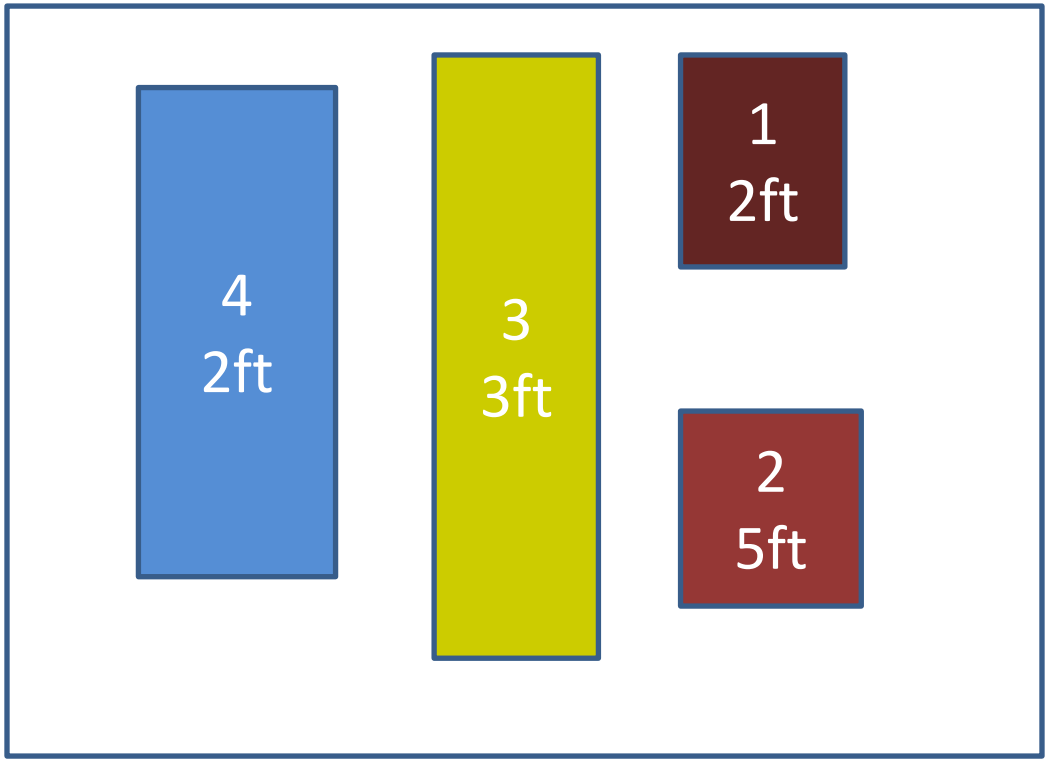
Project #1: Antimicrobial Resistance Genes (ARGs) in Lagoons

Objective: Identify environmental factors that correlate with ARG occurrence and mitigation



USGS 104b.

Lagoons in MARC

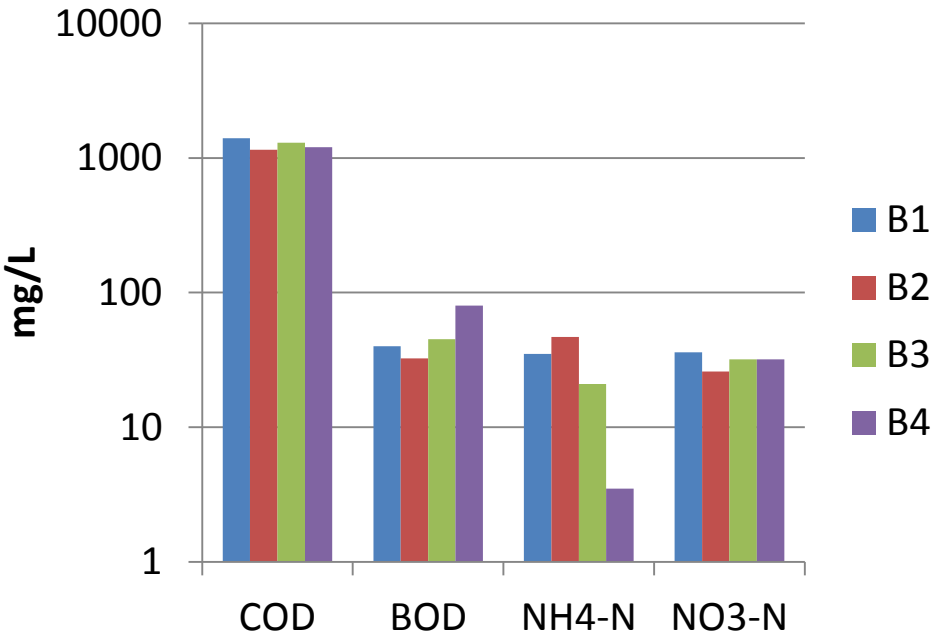


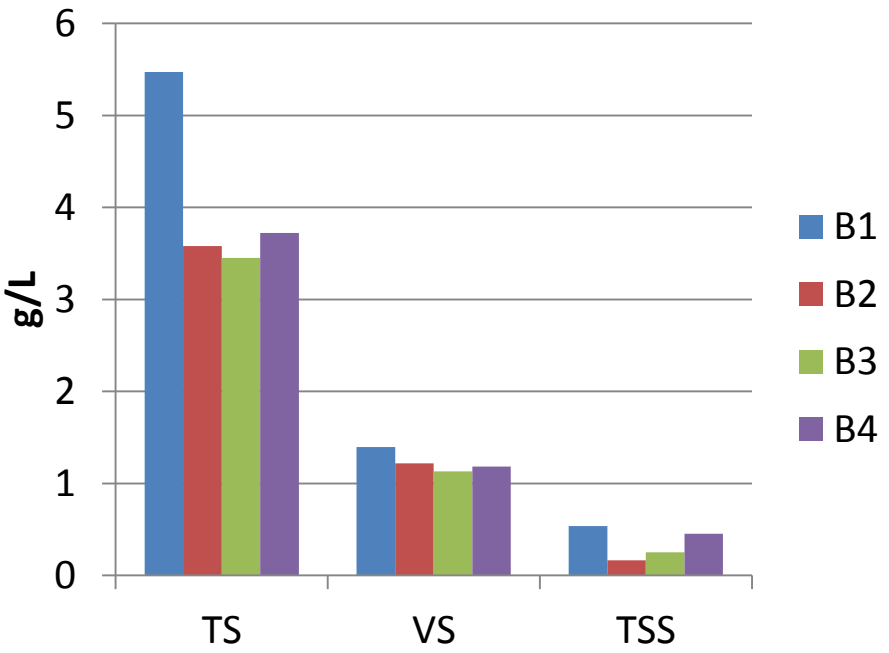
Beef lagoons

#1

#4

Environmental Factors in Lagoons

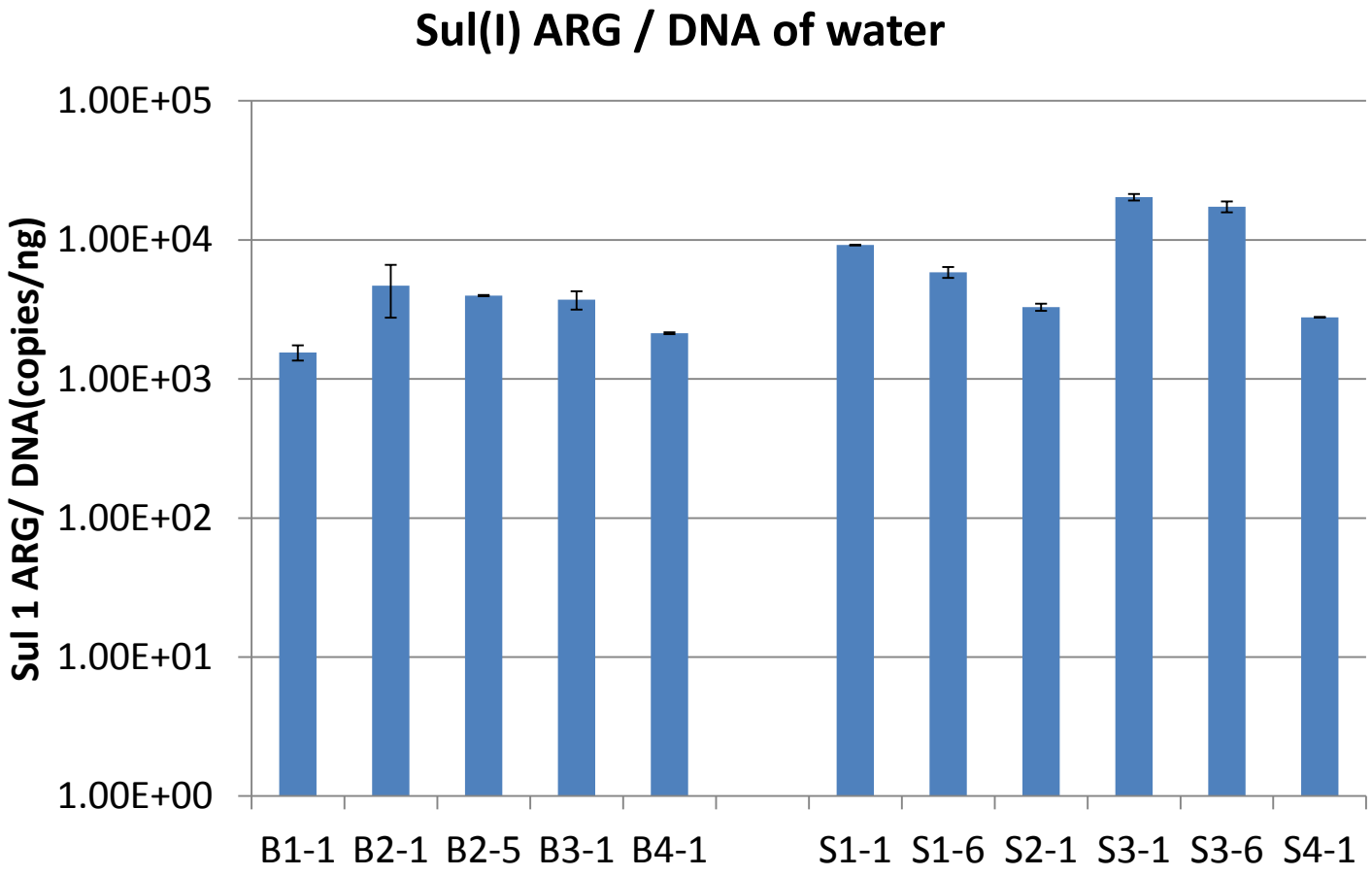




Concentrations of various antimicrobials

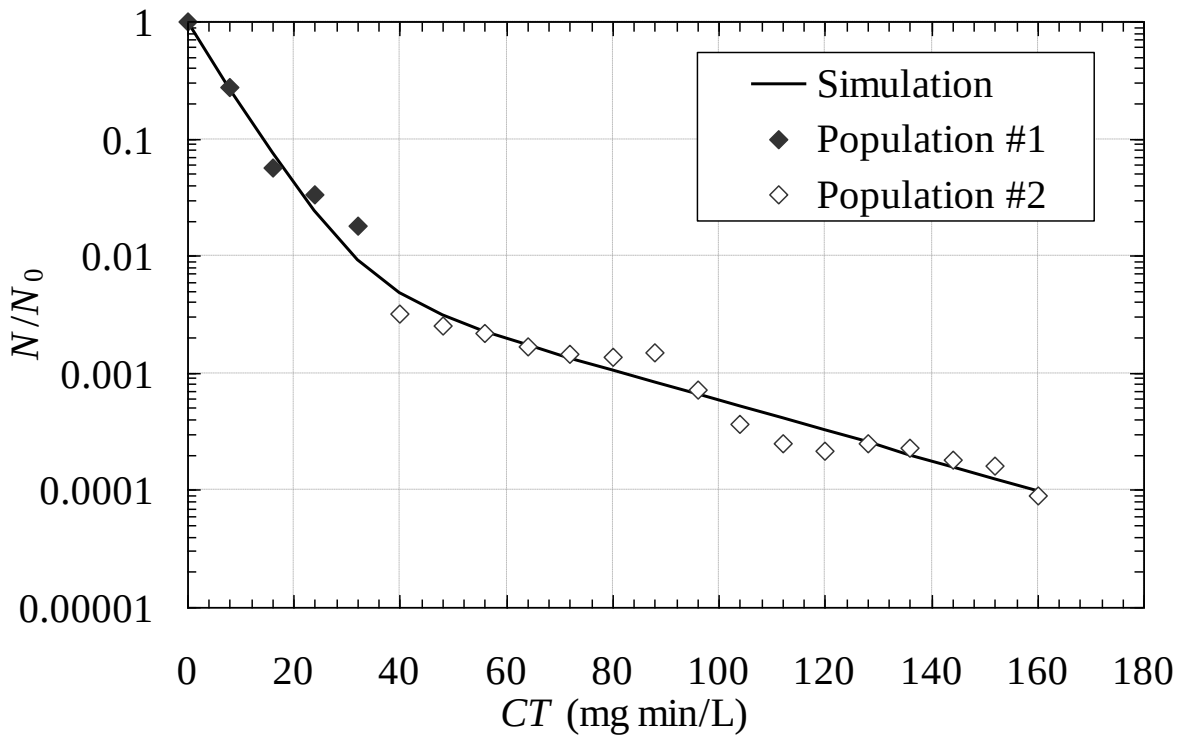
ARGs in Lagoon

Quantitative PCR



Environmental Factors to Test

1. Dissolved oxygen
2. Disinfection



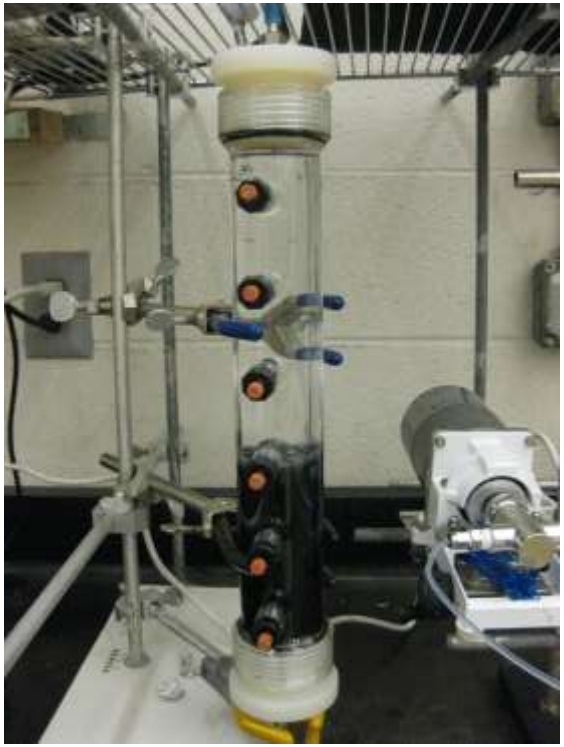
Project #2: Antimicrobial Resistant Pathogens in Food Crops

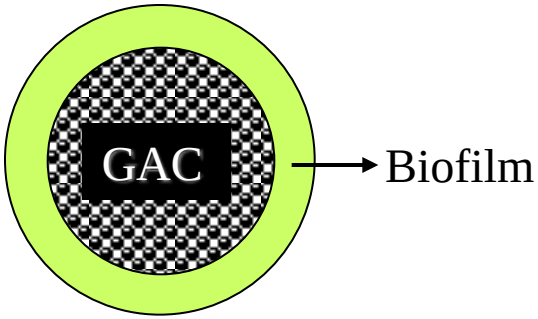
Objective: Understand the fate of antimicrobial resistant pathogens in recycled water before and after irrigation on food crops

USDA

Project #3: Remove Estradiol from Water using a Bioreactor

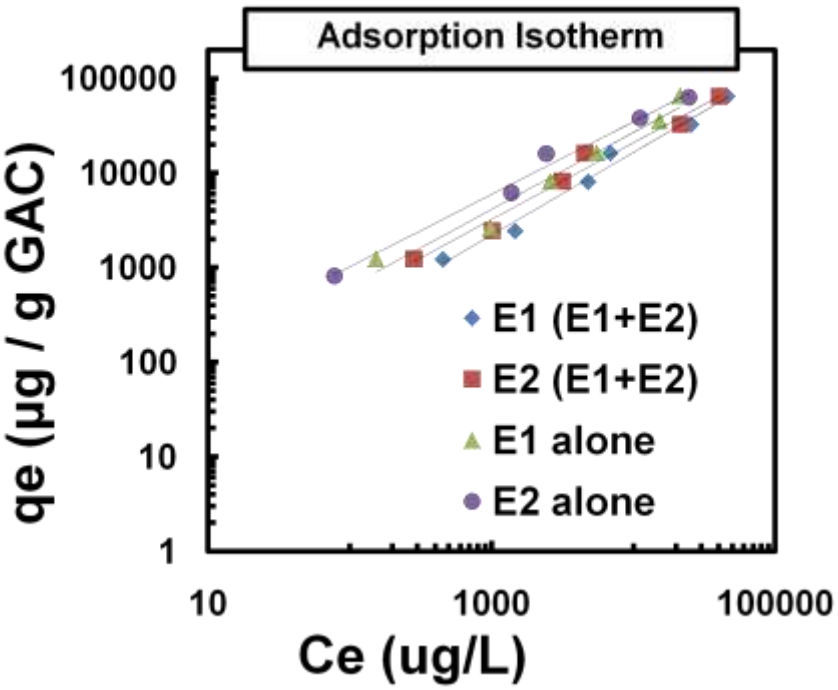
Objective: Develop a bioreactor to effectively remove 17β-estradiol from drinking water.





Physicochemical Process

Adsorption



	K	n
E1 alone	4124.8	1.23
E2 alone	5945.7	1.29
E1 (E1+E2)	2543.3	1.08
E2 (E1+E2)	3545.7	1.04

Values of K, n are based on Ce (ug/L), qe (ug/g carbon)

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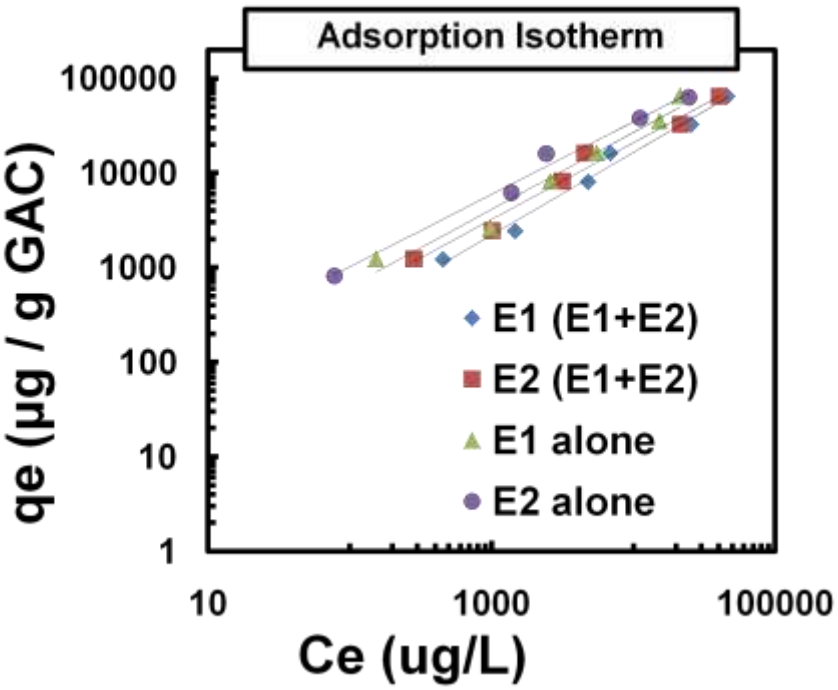

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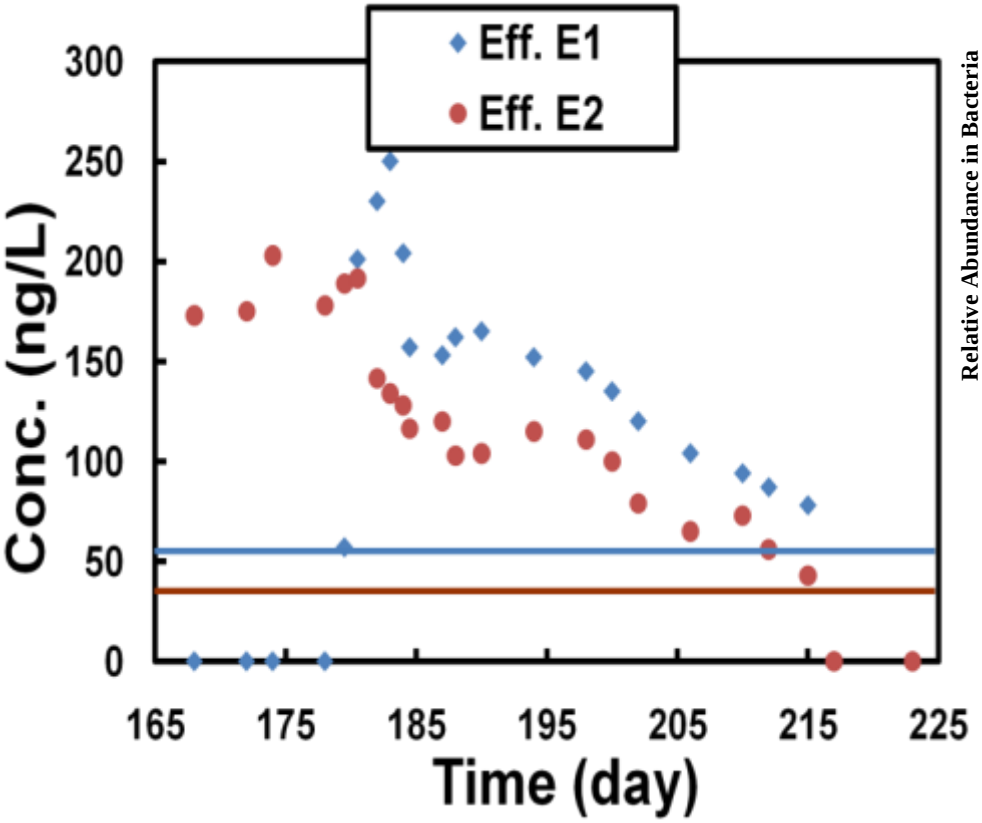
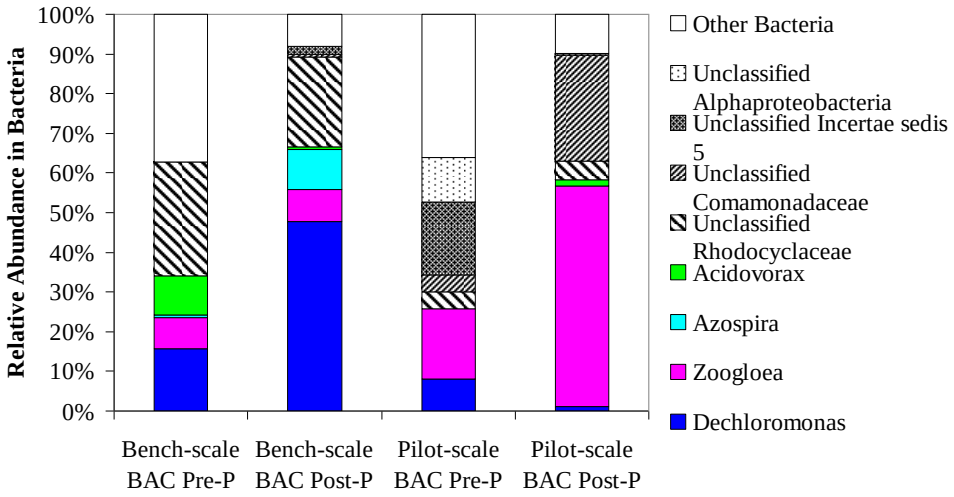
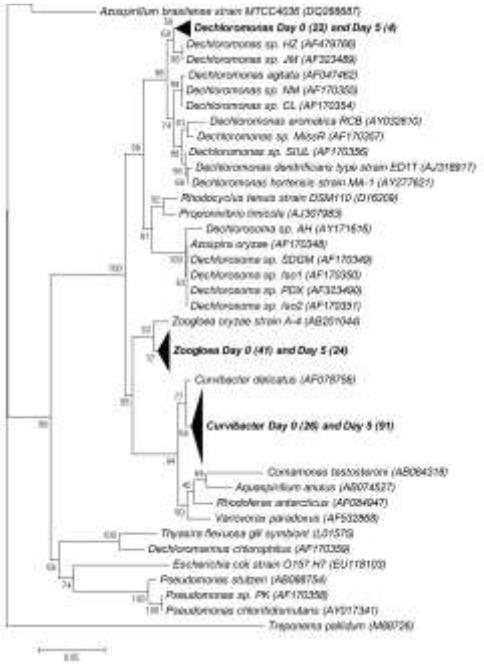
Biological Process

Bacterial Degradation





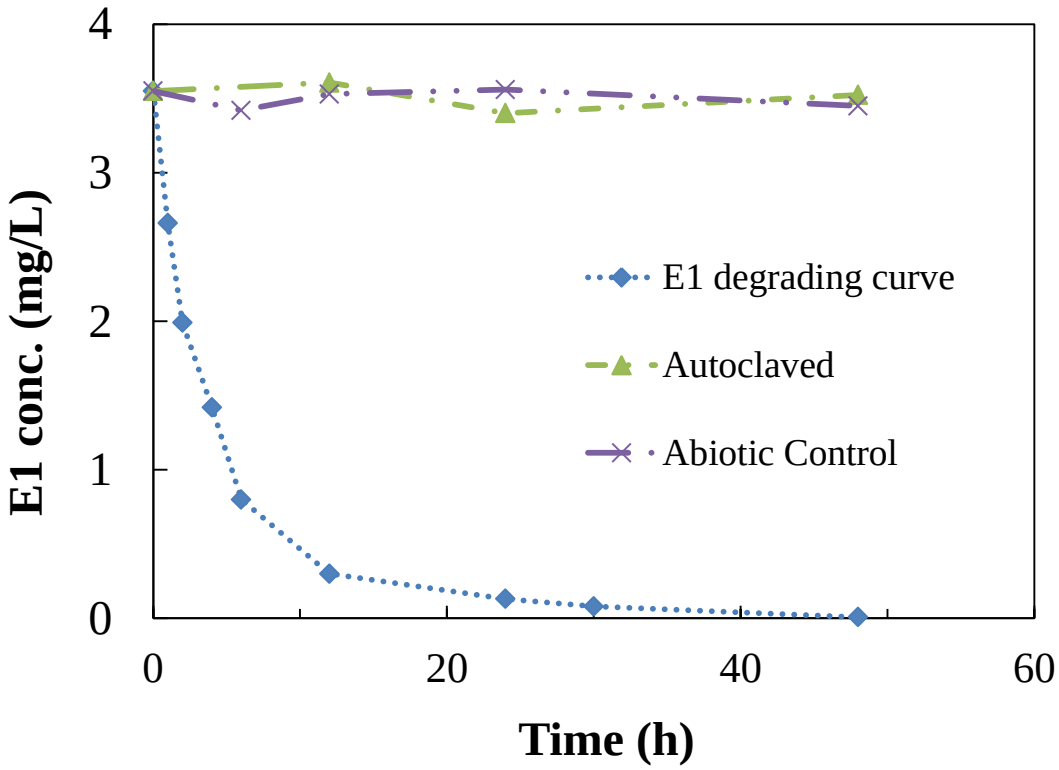


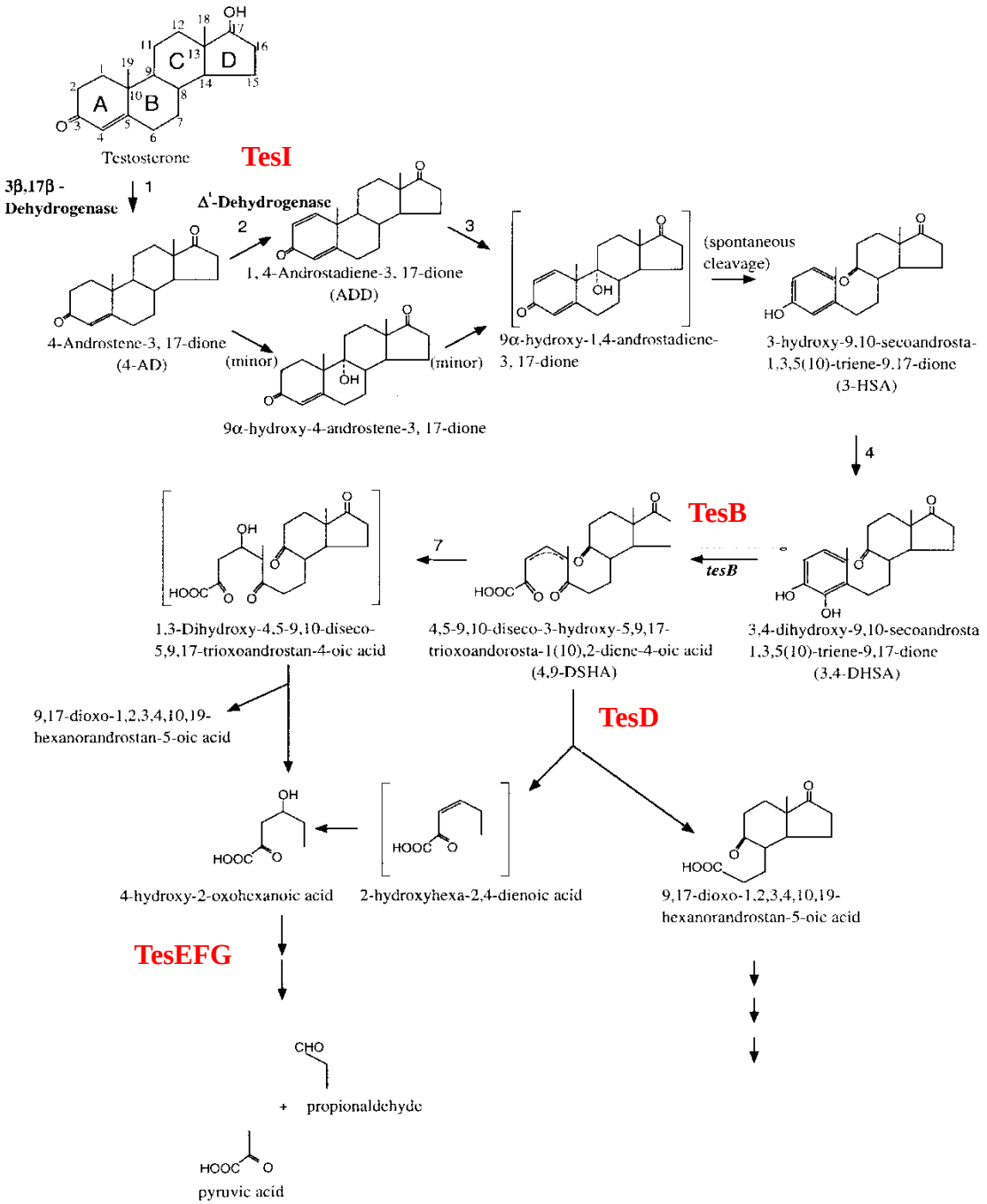
1. Identify estradiol degrading bacteria by isolation and sequencing
2. Analyze the structure of the microbial community using pyrosequencing
3. Follow estradiol degrading bacterial population using qPCR

Project #4: Mechanism of Microbial Hormone Degradation

Objective: Elucidate the pathway of microbial hormone degradation

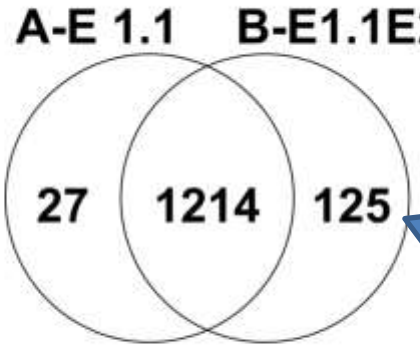
Rhodococcus zopfii





Stenotrophomonas maltophilia

Protein Name	Fold changed after E2 treatment
TesA	+2
TesI	+2
TesB	1
Protein Identification with >90% probability	



Unique protein after E2 treatment:
TesG
TesF

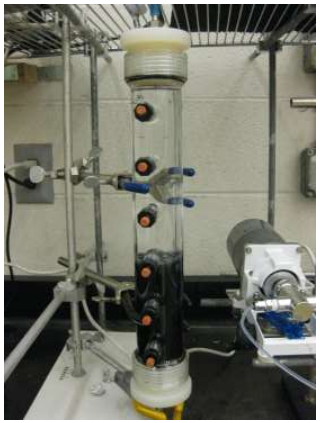
Research Facilities

Env. Engr. and Collaborators'

Total organic carbon analyzer

Real time PCR thermocycler

Rotary evaporator



Various reactors

1. UNL Food Science Pyrosequencing Core Facility
2. UNL Beadle Biotechnology Center
3. UNL Water Sciences Laboratory

Areas of Collaboration

1. Any area that my expertise may help.
2. Microbial activities ~ climate change ~ water quality.